

The Role of Nutrients in Plant Growth

Everyone knows they need to apply fertilizer for optimal growth of fescue and other plants. But what exactly do those nutrients do for the plant?

Nitrogen – Nitrogen is the most frequently deficient nutrient in crop production and most non-legume systems require nitrogen inputs. The primary use of nitrogen in plants is for the formation of proteins. Nitrogen is also an integral part of chlorophyll. Therefore, a plant with sufficient nitrogen will exhibit vigorous vegetative growth and a dark green color while a plant that is nitrogen deficient will be stunted and yellow. Plants normally contain 1 to 5% nitrogen by weight and absorb nitrogen in the forms of nitrate or ammonium. Nitrate and ammonium, if not used by the plant, are readily lost from the soil, resulting in the need for yearly application of a nitrogen fertilizer to meet crop needs.

Phosphorus – The most essential function of phosphorus in plants is in energy storage and transfer. A plant produces energy when it goes through photosynthesis. Much of this energy is stored by phosphorus in the plant to be used later on. Without phosphorus, this energy would be lost. Adequate phosphorus is important early in the life of a plant when roots and reproductive parts of plants are being developed. Ample phosphorus also increases root growth, reduces grain ripening time, and increases straw strength in cereal grains. A large amount of phosphorus exists naturally in the soil but it is often not in the plant-available form, highlighting the need for occasional application of phosphorus fertilizers.

Potassium – Potassium is absorbed by plants in larger amounts than any other nutrient except nitrogen. The total potassium content of a soil is many times greater than what a crop needs, but only a small fraction of this soil potassium is available to the plant, resulting in the need for potassium fertilizer application. Potassium plays a number of roles in the plant including: enzyme activation, water uptake, energy production, sugar transport, nitrogen uptake, and protein synthesis. One of the most important of these is water uptake. Potassium gives plants the “pull” that draws water into their roots. Potassium deficient plants will often exhibit signs of drought stress, even in years when rainfall is adequate.

Calcium – Calcium is essential for plant cell elongation and division, or plant growth. Plants grown in soils that are deficient in calcium will fail to develop terminal buds of shoots and apical tips of roots, which causes plant growth to cease. In corn, calcium deficiency prevents the emergence and unfolding of new leaves while in fruits and vegetables calcium deficiency causes disorders such as blossom-end rot in tomato and bitter pit in apples. Special attention must be given to crops which are unable to obtain sufficient calcium from the soil, such as peanuts, tomatoes, and celery; as well as to crops that have high calcium requirements, such as alfalfa, cabbage, potatoes, and sugar beets. The primary source of calcium as a fertilizer is lime, which is also used to neutralize soil acidity.

Magnesium – Magnesium is a primary constituent of chlorophyll and without chlorophyll plants would fail to carry on photosynthesis. If a plant does not carry on photosynthesis, leaf tissue will turn yellow, then brown, and finally become necrotic. Magnesium also serves as a structural component in ribosomes, stabilizing them in the configuration necessary for protein synthesis.

Magnesium deficiency would cause the proportion of protein nitrogen to decrease and that of non-protein nitrogen to increase. This is especially important in forage crops where high protein levels are necessary to produce a high quality feed. The most common sources of magnesium fertilizer are dolomitic limestone (for agricultural fields) or epsom salts (for gardens).

Sulfur – Sulfur is required for synthesis of a number of amino acids which are essential components of protein. Plants suffering from sulfur deficiency will accumulate non-protein nitrogen in leaf tissue and will influence the food quality of vegetables. Plants experiencing sulfur deficiency will exhibit symptoms similar to nitrogen deficiency, such as stunting or a uniform yellowing of the plant. Plants that are sulfur deficient are commonly misdiagnosed as being nitrogen deficient. Row crop producers often mix ammonium sulfate with Roundup prior to application and, as a result, these fields are rarely deficient in sulfur. Sulfur deficiency is more commonly found in gardens or forage fields.

As can be seen, nutrients perform a variety of function in the plant and deficiency of any nutrient, major or minor, can affect plant health and overall crop yields. As always, the best way to determine potential nutrient deficiencies is with soil and plant tissue testing.